DOCUMENT RESUME

ED 213 853 CE 031 476

TITLE	Safety with Hand and Portable Power Tools. Module SH-14. Safety and Health.
INSTITUTION	Center for Occupational Research and Development, Inc., Waco, Tex.
SPONS AGENCY	Office of Vocational and Adult Education (ED). Washington, DC. Div. of National Vocational Programs.
PUB DATE	81
CONTRACT	300-79-0709
NOTE	33p.; For related documents see CE 031 450-507.
AVAILABLE FROM	The Center for Occupational Research and Development, 601 Lake Air Dr., Suite C, Waco, TX 76710 (Instructor Guides, $9.75 each; Learning Modules, $3.00 each. Entire set of Learning Modules available as two subsets: SH-21, SH-41, SH-43, SH-45, and SH-48, $12.00; remaining 45 modules, $97.50).
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Behavioral Objectives; Equipment; *Hand Tools; *Health Education; Learning Activities; Learning Modules; Postsecondary Education; Safety; *Safety Education; Secondary Education; *Vocational Education
IDENTIFIERS	*Occupational Safety and Health; *Power Tools

ABSTRACT

This student module on safety with hand and portable power tools is one of 50 modules concerned with job safety and health. This module discusses the proper use and maintenance of tools, including the need for protective equipment for the worker. Following the introduction, 16 objectives (each keyed to a page in the text) the student is expected to accomplish are listed (e.g., Name the correct way to cut with a knife). Then each objective is taught in detail, sometimes accompanied by illustrations. Learning activities are included. A list of references and answers to learning activities complete the module. (CT)

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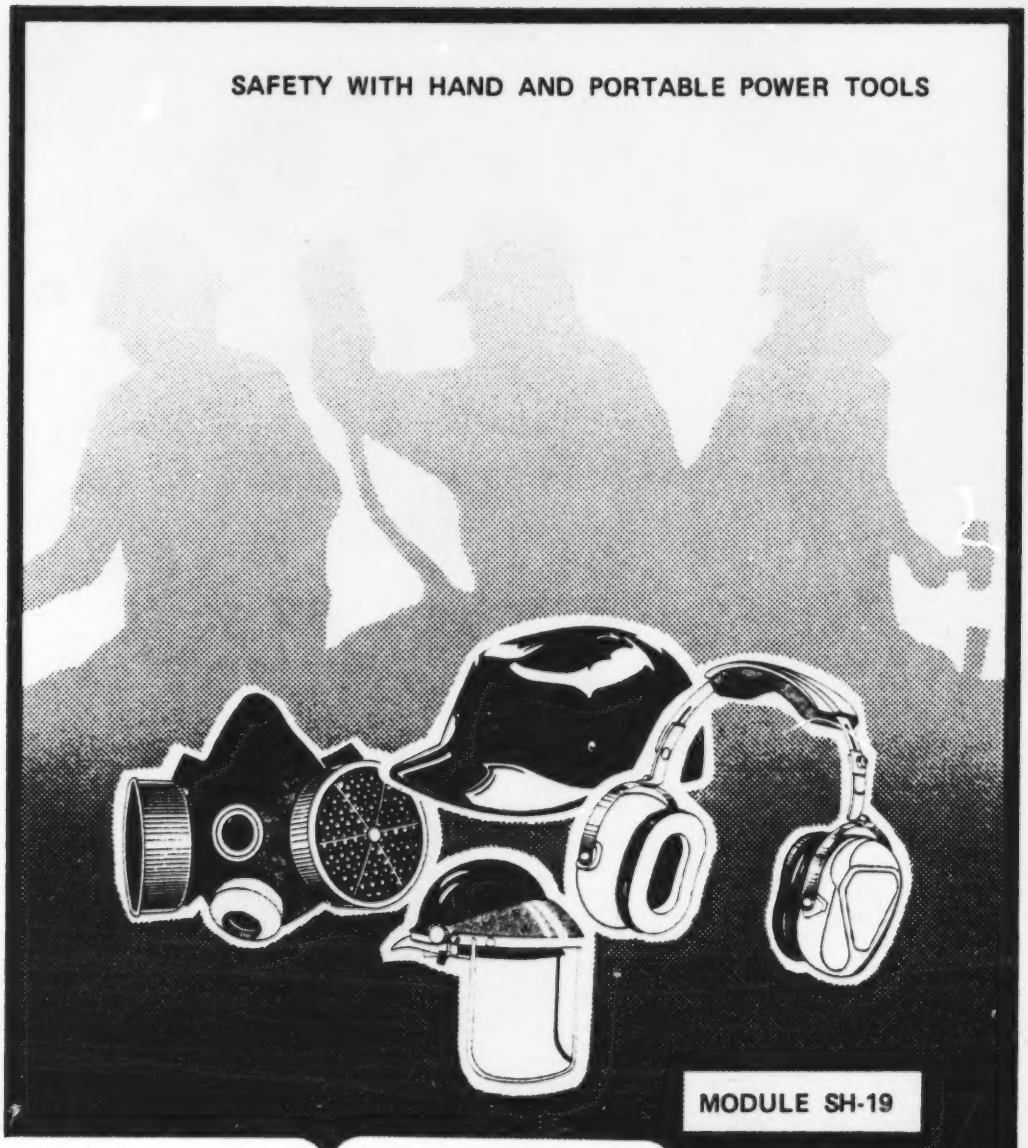
SAFETY AND HEALTH

SAFETY WITH HAND AND PORTABLE POWER TOOLS



MODULE SH-19

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INTRODUCTION

Common hand tools are very familiar to most workers. In some cases, this familiarity breeds contempt – for safety, that is. Workers may have learned early to use these tools incorrectly; in other cases, they have been using the tools for so long that they simply become careless. Whatever the reason, a large number of industrial accidents involve the use of common hand tools.

The National Safety Council says that hand tools cause eight percent of all injuries covered by worker's compensation. Hand tools – and the flying wood or metal they produce – cut off fingers, cause bruises, puncture wounds, and cut tendons and arteries. Infections that develop from such wounds may also result in time away from the job.

Tool safety is a concern that workers, employers and supervisors must work on together, so that (1) the right tools for the job are used, (2) tools are kept and stored properly, (3) regular inspection and reporting procedures are followed, (4) training in correct, safe tool use is continued, and (5) proper eye and face protection is worn.

Many accidents happen when tools are carried, stored or passed from one worker to another with the sharp edges pointed outward or when workers lose their balance because the weight of the tools. Using the wrong tool for the job, or using defective tools also causes accidents.

This module discusses the proper use and maintanance of tools, including the need for protective equipment for the worker.

OBJECTIVES

Upon completion of this module, the student should be able to:

1. List two responsibilities of the employee in charge of giving out tools from a central tool control. (Page 3)
2. List four unsafe practices that can cause accidents with hand tools. (Page 4)
3. Name the proper place to grip a hammer and explain the reason for gripping it there. (Page 6)

4. Name at least five ways a screwdriver should not be used. (Page 9)
5. Describe the danger of making the handle of a wrench longer with a pipe. (Page 12)
6. Name the direction in which the worker should move a saw when making the first cut. (Page 13)
7. Name one method of providing hand protection when working with chisels. (Page 14)
8. State the reason for not using a chisel as a hammer, wedge, or pry. (Page 16)
9. Name the correct way to cut with a knife. (Page 17)
10. List three types of protective clothing that must be worn when working with power tools. (Page 18)
11. Name two ways that power tools should be stored. (Page 21)
12. Name two ways to prevent electric shock when working with electrical power tools. (Page 22)
13. Name two hazards that are present when the air hose of a pneumatic tool is suddenly disconnected or cut. (Page 24)
14. Name one precaution to take when using a hydraulic jack. (Page 25)
15. State the main hazard associated with use of gasoline-powered tools. (Page 26)
16. Name the person permitted to operate a powder-actuated tool. (Page 26)

OBJECTIVE 1: List two responsibilities of the employee in charge of giving out tools from a central tool control.

Although many tools are tested by special testing firms and meet certain standards, an employer is responsible for seeing that all tools — even those that a worker brings to the job — are in safe working condition.

The best way to keep track of how tools are being used or kept is to have one place where tools are stored, where records are kept that show where and when tools were bought, how they are being used, and how often they are replaced. The worker in charge of this should know (1) how to use each tool correctly, and (2) how to recognize when any of the tools are damaged. If such a system is used, and workers know they can turn in damaged tools to get new ones, they are more likely to use tools that are in good condition.

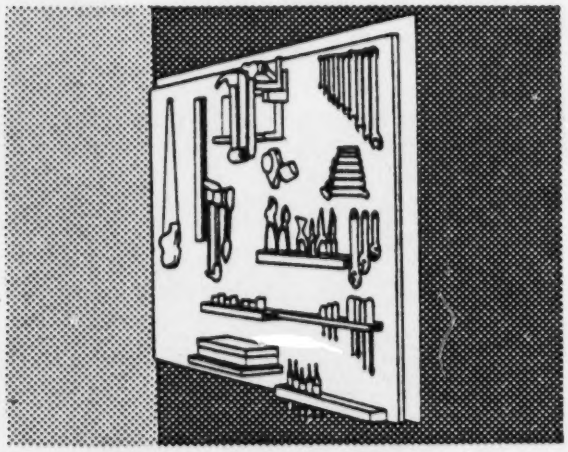

Figure 1. Tool storage.

If tools are owned by the workers, training should be given to workers on how to decide if a tool is in poor condition and how to fix it.

In workplaces where there are only a few workers and a complicated system is not needed, a place where all tools can be stored for use, such as in Figure 1, must be provided. Tools should be organized so they can be found quickly, not left lying around where they could cause accidents. Keeping tools organized will also save time on the job, since workers will not have to search for needed tools.

ACTIVITY 1:*

List two responsibilities of the employee in charge of dispensing tools from a central tool control.

1. _____
2. _____

OBJECTIVE 2: List the four unsafe practices that can cause accidents with hand tools.

Accidents that happen with hand tools are usually caused by one or more unsafe practices:

- Using a tool that is damaged.
- Using the wrong tool for the job.
- Using the right tool in the wrong way.
- Not keeping tools in good condition.

Although the employer must make sure safe tools are used on the job, the worker must also watch for damaged tools and turn them in for repair. The worker must be careful about the proper handling and day by day care of tools, which must be kept clean at all times. Metal parts especially must be wiped clean after each use to protect them from rust.

Any moving parts of tools such as pliers or adjustable wrenches must be lubricated regularly to prevent wear. The cutting edges of tools should be kept sharp, since dull blades can slip and cause injuries.

Tools with handles, such as hammers, must be checked to make sure the handle fits tightly into the head of the tool to prevent the head from flying off and hitting someone. If the handle of a tool is rough or contains cracks, splinters or other defects, the tool should not be used as it could injure the worker's hand.

Tools should be inspected before each use to make sure there is no damage. Tool damage can occur in two ways. First, a tool can be damaged by using it the wrong way. For example, using a screwdriver as a pry will change the head of the screwdriver. If the damage is not noticed the next time this

*The answers to activities for this module can be found on page 29.

Figure 2. Tool should not be carried in worker's pocket.

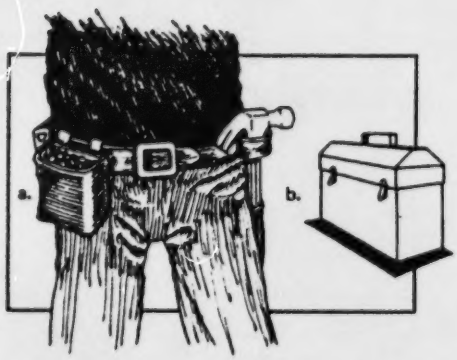

Figure 3. Tool belts and tool boxes.

screwdriver is used, it might slip and seriously wound a worker's hand.

Second, a tool can be damaged by using it the wrong way so that it wears out and becomes dangerous.

Workers must be told how to carry hand tools the right way. Carrying tools the wrong way damages the tools and causes a great number of workplace accidents. A tool should never be carried in a worker's pocket as shown in Figure 2. The tools could puncture the worker or other employees passing by. Leather tool belts, Figure 3a, and tool boxes, Figure 3b, are effective for carrying tools safely.

When a tool is found to be defective, it must not be used until it is properly repaired. Temporary repairs, like taping the cracked handle of a hammer, should never be attempted, because the tape will hide the damage, making the use of the hammer dangerous (Figure 4).

Using the right tool in the wrong way has caused many accidents in the workplace. The employer must make sure that a worker has been taught the proper use of each tool that will be used for the job. Then the worker must make sure that each tool is used properly.

The easiest way to do something is not always the safest way. For instance, a worker using a wrench needs more leverage to turn a bolt, so rather than taking the extra time to get the proper size wrench, the worker uses a pipe over the wrench handle to increase leverage. The result is that the

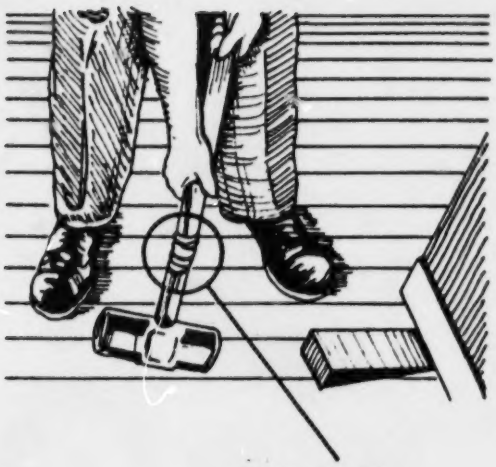

Figure 4. Temporary repairs of damaged tools are dangerous.

wrench slips from the bolt, comes out of the pipe, and strikes the worker in the head, causing serious injury. A worker should never give up safety for convenience, since he or she is the one who suffers the consequences.

Keeping tools in good condition will increase the life of the tools, make the tools safer to use, and let the worker do better work with fewer risks.

Fixing and keeping tools in good condition should be carried out by specially-trained personnel.

ACTIVITY 2:

List the four unsafe practices that can cause accidents with hand tools.

1. _____
2. _____
3. _____
4. _____

OBJECTIVE 3: Name the proper place to grip a hammer and explain the reason for gripping it there.

Perhaps the most often used of all hand tools is the hammer. It is used for driving, pounding, flattening, and shaping objects. Before any hammer is used, regardless of the type, it should first be checked to make sure that the head is not loose and that the handle is not cracked or damaged. Many serious injuries have happened when the head of a hammer has come loose from the handle while the hammer was hitting something.

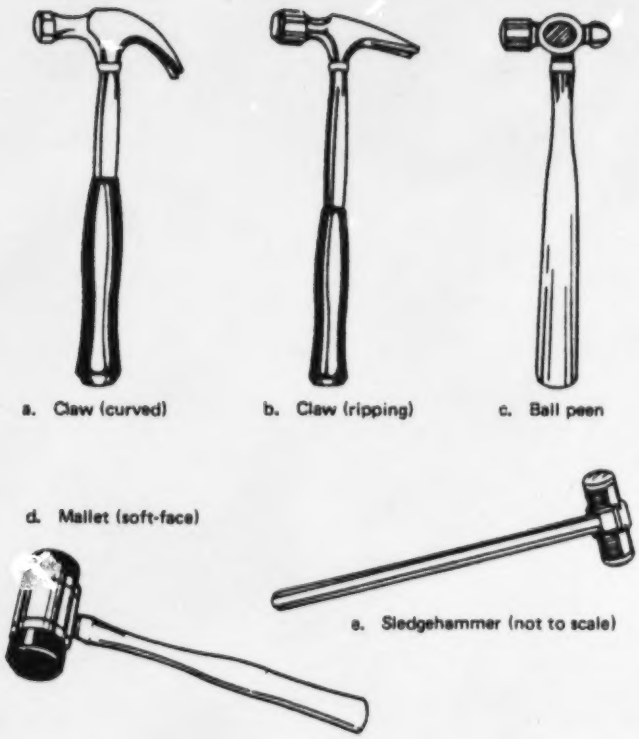

Figure 5. Hammers.

Hammers come in different types and shapes, each made for a special purpose. The hammer with which most people are familiar is the common claw, which is used to drive nails, dowels, or other fasteners. The curved-claw-hammer, as shown in Figure 5a, is used to pull out nails or rip apart wood framing. If the claws are only slightly curved, as the one illustrated in Figure 5b, the hammer is better suited to ripping than to nail pulling.

A ball peen hammer, illustrated in Figure 5c, is also known as a machinist's hammer. Its head is made for driving and shaping metals. The top of the head is rounded for flattening rivets. The striking face is slightly rounded and is used for striking chisels and driving metal pins and other metal-working tools.

A mallet, or soft-face hammer, shown in Figure 5d, is used for pounding or driving where a steel-faced hammer would damage the work. Soft-faces can be made of plastic, copper, lead, rawhide, wood, or rubber.

A sledgehammer, as shown in Figure 5e, is large and heavy and usually swung with two hands. It is most often used for driving stakes or breaking stone.

To give better control and a heavier blow, hold the hammer near the end of the handle — no matter how hard a blow you need, because the force of the blow is determined by the weight of the hammer and the distance the head travels. If you hold it closer to the head, the blow is not as hard and it is

harder to hold the hammer straight. If a small force is required, then a light-weight hammer should be used with short swings. Wildly banging a nail with a hammer is a dangerous practice. The nail could fly off at high speed, hitting someone's face or eye.

Safe ways to drive a nail are listed below:

1. Hold the nail near its point with thumb and forefinger (Figure 6a).
2. Place the point of the nail on the work.
3. Then strike the head of the nail several light blows with the hammer to start the point of the nail into the wood.
4. Next, get fingers out of the way (Figure 6b).
5. Make sure that the hammer hits the nail squarely.

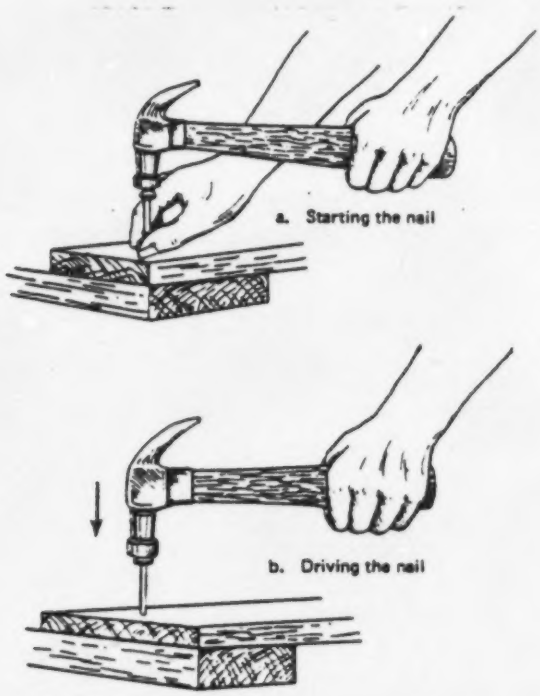

Figure 6. Safe procedures for driving a nail.

To pull a nail safely with a claw hammer, the head of the nail must be slightly above the surface of the material so that the claws of the hammer can be pushed under the head of the nail. The slot between the claws should be caught firmly around the nail and under the nail head (Figure 7a). If the nail is a short one, it should come out of the material when the hammer handle is raised at right angles to the material. When the hammer handle passes this point, the leverage is weakened. If this happens, place a piece of wood between the material and the hammer as shown in Figure 7b. This will place the hammer handle in a flatter position and improve the leverage.

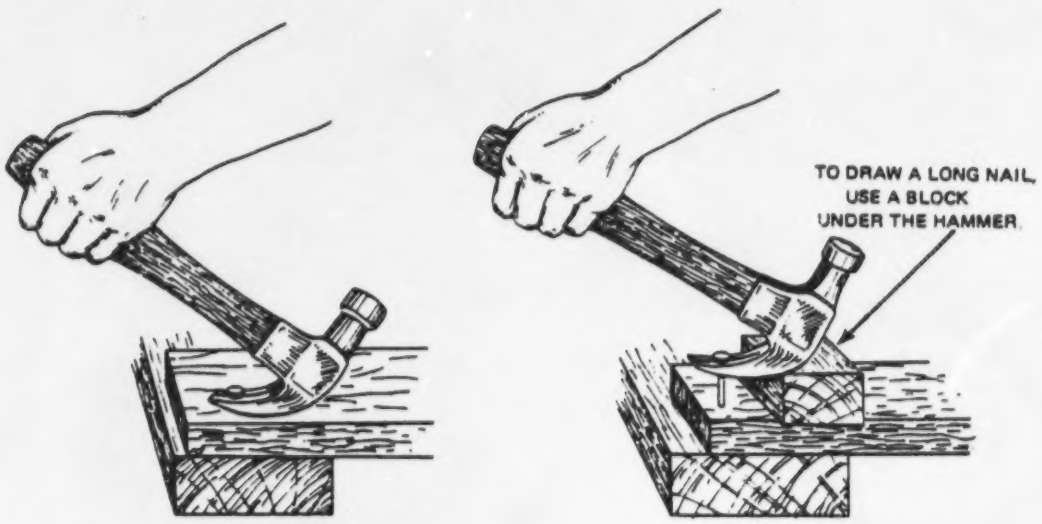

Figure 7. Safe ways to pull a nail with a hammer.

ACTIVITY 3:

Name the proper place to grip a hammer, and the reason for gripping it there.

_____

_____

OBJECTIVE 4: Name at least five ways a screwdriver should not be used.

Almost everyone has used a screwdriver at one time or another, and probably, at one time or another, almost everyone has used a screwdriver incorrectly. A screwdriver has two basic purposes: to loosen a screw or to tighten a screw. But the screwdriver is often misused for other things, such as for prying, which is very dangerous and should never be tried. The tip of a screwdriver is made hard to keep it from wearing. This means the blade is brittle and can be easily broken if used as a pry. A broken tip can fly into someone's face and cause serious injury to the face or eyes.

Because a screwdriver is often misused, it is important that workers know how dangerous this is. Things to avoid when using a screwdriver are listed here:

- A screwdriver must never be used to check for current flow in an electrical circuit (face, hands, and eyes can be injured by the resulting flash).
- A screwdriver must never be used as a chisel (the blade tip will be damaged and hazardous).
- A screwdriver must never be used to punch holes (the screwdriver could slip and the tip would be driven into the hand).
- The handle of a screwdriver should not be used as a hammer (the blade can puncture a hand).

Screwdrivers come in different sizes and shapes. Each is made for a specific job and should be used only for that job.

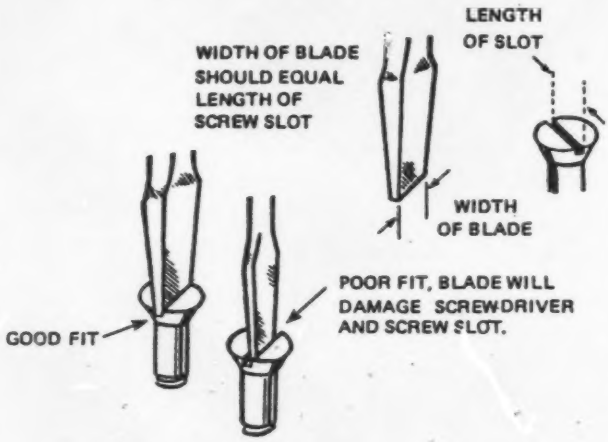
WIDTH OF BLADE SHOULD EQUAL LENGTH OF SCREW SLOT
LENGTH OF SLOT
WIDTH OF BLADE
POOR FIT, BLADE WILL DAMAGE SCREWDRIVER AND SCREW SLOT.
GOOD FIT

Figure 8. Fitting a blade to a screw slot.

Choosing the right screwdriver for a job means finding one where the thickness of the tip of the screwdriver makes a good fit in the screw slot. A good fit of the two will stop the screw slot and the blade tip from being damaged and will make it easier to turn the screwdriver. The thickness of the screwdriver's blade should fit snugly in the screw slot, and the width of the blade should be about the length of the slot, as illustrated in Figure 8. If the blade is wider than the slot, the work surface will be marred. If the blade is too narrow, the screw head or the screwdriver may be damaged.

Listed below in proper order are the steps for driving a screw correctly.

1. Prepare the holes for the screws by using pilot holes, counterbores, or countersinks.
2. Choose the proper screwdriver for the job. The longest screwdriver that is appropriate for the work should be used so that the greatest effort can be applied with least danger of the blade slipping out of the slot.
3. Put the tip of the screwdriver in the center of the slot of the screw.

4. Hold the handle firmly with the right hand, with the top of the handle against the palm, and thumb and finger against the metal band below the handle, as illustrated in Figure 9.
5. With the left hand, guide the screwdriver into the screw.
6. To drive in the screw, turn the screwdriver clockwise.
7. When taking a new grip with the right hand, steady the tip of the screwdriver by keeping it firmly pressed into the slot of the screw with the left hand.
9. Relax the grip of the thumb and finger of the left hand when the screwdriver is turning.

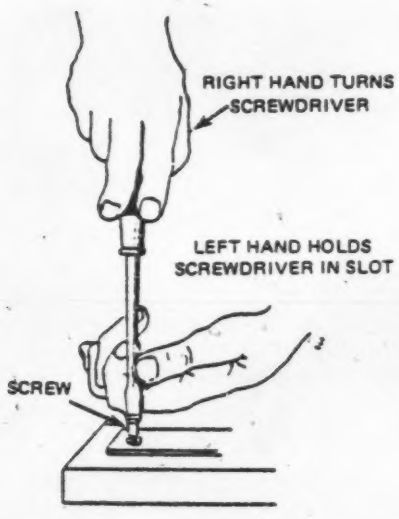

Figure 9. Safe use of a screwdriver.

Do not try to drive the screw any farther than to seat it firmly. Too much force can strip the threads on the head of the screw.

Removing a screw is much the same as driving a screw. However, before you attempt to remove a screw, the screw slot must be cleaned out to prevent the screwdriver from slipping. The direction you turn the screw for taking it out will be opposite that for driving it.

Proper maintenance, or dressing, of a screwdriver is a must. The tip of the screwdriver blade should be straight, as shown in Figure 10a. A blade that tapers or is rounded, as in Figure 10b, will have a tendency to rise out of the screw slot.

There are two ways of dressing screwdrivers: (1) by using a common flat file, and (2) by grinding. If the first method is used, the screwdriver must first be held firmly in a vise. If you grind it on an emery wheel, make sure that the blade of the screwdriver is not held too long against the stone. Too much friction on the blade will heat the steel of the blade, and draw out the

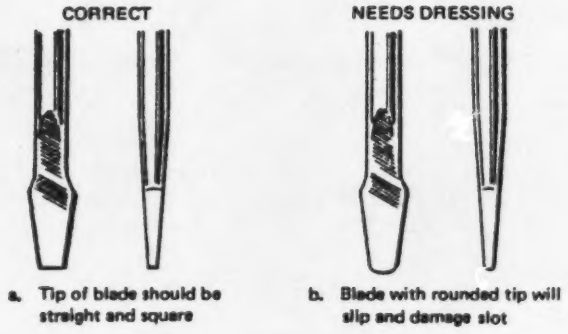

Figure 10. Correct and incorrect screwdriver tips.

"temper" (degree of toughness) of the blade, making it soft metal. During the grinding process, the blade must be dipped into a container of water to cool it. If the blade changes color, it is overheated. The blade should be filed or ground so that the flat sides are as shown in Figure 10a.

ACTIVITY 4:

List five ways NOT to use a screwdriver. Begin each sentence with "Do not."

1. _____
2. _____
3. _____
4. _____
5. _____

OBJECTIVE 5: Describe the danger of making the handle of a wrench longer with a pipe.

A wrench is used for making bolt heads, nuts, studs, or pipes tighter or looser. The open-end wrench, shown in Figure 11a, is a most important tool because it can be used in so many ways.

Other wrenches have ends that are closed, as the box-end wrench, shown in Figure 11b. This wrench also has an angled head that can be used in places where a flat wrench cannot reach. Box-end wrenches are safer to use than open-end wrenches because they are less likely to slip off the nut or bolt, but they must be used in places where you can get to the bolt or nut from the top and they cannot be used when the bolt has to be approached from the side.

a. b.

Figure 11. Wrenches.

It is important to choose the proper wrench for a given job. The right wrench to use is decided by the location of the nut or bolt and the size of the head. The size of a wrench is determined by the width of the opening.

If you use a wrench which is too large, you will round off the head of the bolt or screw, and may cause the wrench to slip and cause injury.

To use a wrench safely, the worker must grip it firmly with the hand clear in case the nut should suddenly turn. The wrench should be pulled, not pushed. When the wrench is pushed, it is usually toward an obstruction; when it is pulled, it is away from the obstruction. There may be times when it is necessary to push a wrench. In this case, spread the fingers and use the heel of the hand to push the wrench. This will prevent broken fingers if the wrench should slip.

Wrenches have been designed with the proper size handle for the size of the wrench. The worker must never make the handle longer with a piece of pipe since the added leverage can cause the wrench to break and injure the worker.

ACTIVITY 5:

Describe the danger of making the handle of a wrench longer with a pipe.

_____

OBJECTIVE 6: Name the direction in which the worker should move a saw when making the first cut.

Another often-used tool is the hand saw. A safe saw is a sharp saw. A saw cuts easily when properly sharpened and set. The proper care and maintenance of a saw is essential for safe use. Moisture on the blade of a saw, unless the surface is well protected by a film of oil, will produce rust

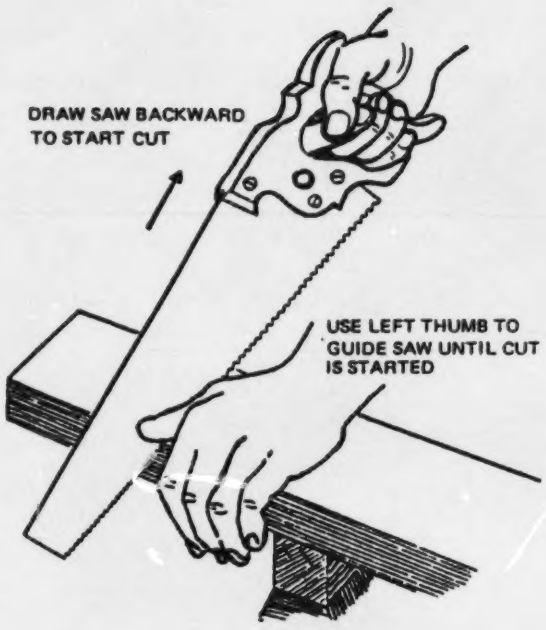

Figure 12. Safe way to start a hand saw.

immediately. Rust will pit and roughen the smooth sides of a saw blade. Saws should be stored in a dry place and hung up when not in use. When a saw is laid down, it should be done with care to prevent it from dropping.

The cut, or kerf, is started by drawing the saw backward across an edge of the material on the waste side of the line (Figure 12). The blade should be guided with the tip or the first joint of the left thumb. This must be done carefully to avoid cutting the thumb.

To protect the teeth of the saw, pressure should be applied only as the saw moves forward, and the saw should be lifted slightly when pulling back in the cut. If too much pressure is applied, or the blade is twisted, the blade may break and cause an injury to the hand or arms of the person using the saw.

ACTIVITY 6:

Name the direction in which the worker should move a saw when making the first cut. _____

OBJECTIVE 7: Name one method of providing hand protection when working with chisels.

Chisels are both wood- and metal-working tools. Wood chisels, as illustrated in Figure 13a and b, are made to do cutting jobs in hard to reach places that cannot be reached with a saw or plane (such as the rectangular notches for butt hinges on a door).

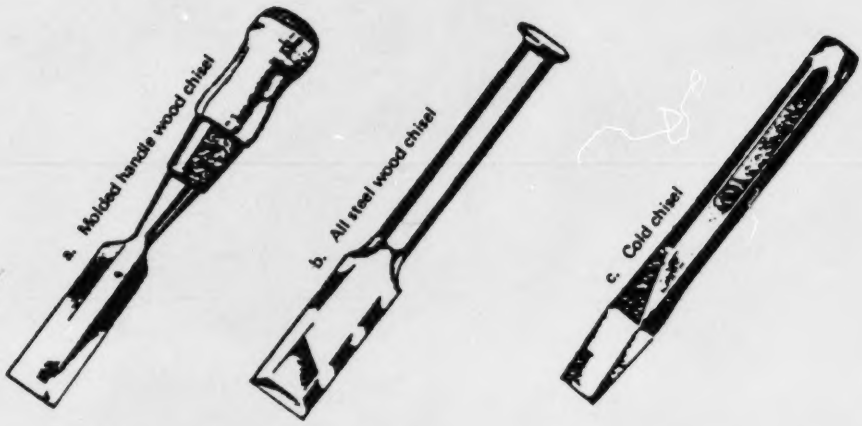

Figure 13. Common type chisels used in industry.

When a wood chisel is used, the worker should chisel from the layout line toward the waste wood. Then if the wood splits, it will split in the waste wood.

A metal chisel, as illustrated in Figure 13c is used for cutting off rivet heads, splitting nuts that cannot be removed otherwise, and many other tasks.

The chisel used must be big enough for the job it is to do, and the hammer used should be the correct weight for the chisel size; the larger the chisel, the heavier the hammer.

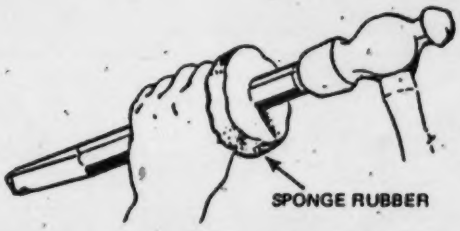

Figure 14. Hand protection for use with hammer-struck tools.

Hand protection is a major concern in working with chisels since chisels should only be used when sharp. One method used to protect the worker's hand is to push a sleeve of rubber padding over the chisel, above the workers grip, as shown in Figure 14.

Flying chips pose another hazard in working with chisels, so people working in the area should wear safety goggles or be protected from chip hazards by a screen around the work site.

When a chisel is held by one worker and struck by another, tongs or a chisel holder should be used and both workers should be wearing goggles and safety hats. The worker striking the chisel should work barehanded to avoid losing grip.

Grind a chisel only when (1) you have to restore the angle of the bevel (the sloping part near the tip), (2) the cutting edge has become badly nicked, or (3) the bevel has become too short or rounded as a result of careless or frequent whetting. Whetting methods are shown in Figure 15. Use a common

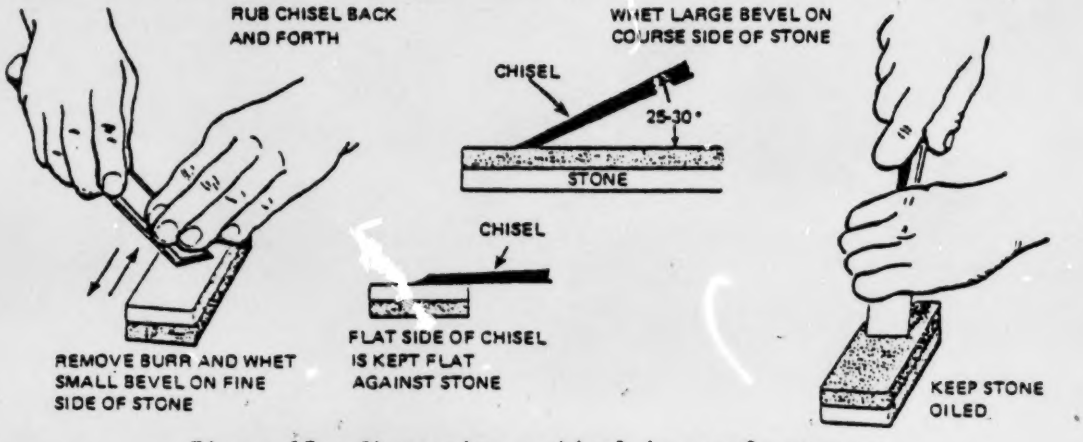
RUB CHISEL BACK AND FORTH
WHET LARGE BEVEL ON COURSE SIDE OF STONE
CHISEL
25-30°
STONE
CHISEL
FLAT SIDE OF CHISEL IS KEPT FLAT AGAINST STONE
REMOVE BURR AND WHET SMALL BEVEL ON FINE SIDE OF STONE
KEEP STONE OILED

Figure 15. Sharpening a chisel in a safe manner.

oil stone with fine grit on one side and coarse grit on the other to grind a chisel. Whetting should not be performed on a dry stone. A general-purpose lubricating oil should be applied to the stone.

ACTIVITY 7:

Name one method providing hand protection when working with chisels. _____

_____

OBJECTIVE 8: State the reason for not using a file for a hammer, wedge, or pry.

Files, like chisels, are cutting tools used where it is not a good idea or it is not possible to use another type of cutting tool. Use of the correct

file for the task will help to prevent injury while making the file last longer. Do not use a file that does not have a handle, since this has caused many accidents.

Files are formed of hard, brittle steel that makes them likely to chip or crack; so they should never be used as a hammer, wedge, pry, or as any other tool.

A file should never be cleaned by striking it against another object – a brush designed for cleaning should be used. Small pieces of metal collect in the teeth of the file as it cuts, so to be safer, workers should always wear safety goggles when trimming corners or edges of metal sheets. Leather or very heavy canvas gloves will protect the worker's hands from the sharp edges of sheet metal.

ACTIVITY 8:

State the reason for not using a file for a hammer, wedge, or pry. _____

OBJECTIVE 9: Name the correct way to cut with a knife.

Knives cause many accidents. To avoid accidents with them, a supervisor should make sure everyone obeys the rule against knife games – they are too dangerous. Good storage of knives can prevent many injuries; as with other sharp-edged tools, knives should be put away after each use. They should always be carried and stored in protective sheaths, as illustrated in Figure 16. One important rule to remember is – never allow a knife to lie hidden in soapy water or beneath stock, food, or other material that might prevent its being seen.

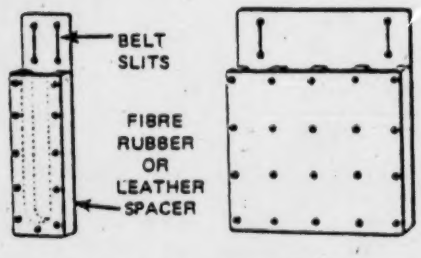

Figure 16. Sheaths for sharp-edged tools.

Workers who carry a knife on a belt should put the carrier over the right or left hip, rather than in front, to lessen the chance of a bad leg injury in case of a fall.

Choosing the correct knife for the job is important, both to safety and efficiency. Many times a knife is used for a job where a more appropriate tool exists. Workers who open cartons should use a knife with a curved blade, such as a linoleum knife, rather than a pocket knife, which does not allow good control of pressure on the cutting edge, and may close unexpectedly.

Workers who use knives need plenty of room in which to work so they will not be bumped, and should always cut away from or out of line with the body. Protective clothing should be worn (often a heavy leather apron), and the hands and body kept clear of the knife. If the knife must be wiped, a cloth for that purpose should be used and the cutting edge of the knife turned away from the worker.

It is best to buy knives that have guards or to add guards so that the worker's hand will not slide down over the blade.

ACTIVITY 9:

Name the correct way to cut with a knife.

_____

OBJECTIVE 10: List three types of protective clothing that must be worn when working with power tools.

Good industrial-strength power tools allow the worker to work more efficiently, with less fatigue, and often with greater accuracy than do hand tools. But power tools made for the specific job are needed for the best results and greatest safety. The attachments of these tools should be specially suited to the material being used and to the extent of the work.

Owners' manuals and training courses are useful for teaching workers the best and safest ways to use power tools. Workers must learn about switches and adjustments, and practice changing accessories on the tool before plugging it in. Then they should practice on scrap material (under supervision) before using the tool on the job.

Workers should also be taught to care for power tools by cleaning and oiling them – and to recognize worn or damaged parts. Clean, well-lubricated power tools make the job more efficient and safer. Tools should be inspected

at regular intervals for defects, tagged to record the inspection, and withdrawn for repair when necessary. Repair work should be done only by trained individuals.

Although most of the modern power tools have built-in safety features which make them quieter, keep particles of dust or material confined, and give better accuracy and control, the user must still look on the tools as possibly hazardous and take the needed safety precautions.

Protective clothing must be worn where the user could get hit by falling objects, sharp objects, or tiny bits of metal, dust, or wood. Safety shoes with steel toes should be worn to reduce the chance of injury to the feet and toes.

Safety helmets, similar to the one shown in Figure 17, must be worn to protect the worker from flying objects and electric shock. To prevent scalp disease, each worker should have his or her own personal helmet.

Figure 17. Head protection for workers.

The choice and use of headgear depends on the type of job. Various types of headgear used in specific jobs are shown in Table 1. Helmets should be kept up and cleaned according to manufacturer's instructions and thrown out when damaged.

Face and eye protection are given by adding special attachments to the helmet, such as lift fronts, goggles, and unbreakable glasses (for workers with prescription eyewear).

TABLE 1. FITTING HEAD COVERINGS TO TYPES OF JOBS.

Safety Equipment	Job	Protection from
Hard hat	Construction and fabrication	Falling or moving objects
Bump hat	Administration areas and confined spaces	Cuts and bruises to scalp
Welder's skull cap	Welding and hot metal	Burns to hair and scalp
Sweat band	All	Perspiration in eyes and on glasses

Industrial-quality safety glasses and goggles prevent things from hitting and piercing the eyes. They also have stronger frames and safety lens that must meet stricter tests for resistance to impact than regular glasses.

Ear muffs or specially made earplugs are needed if the noise level is measured to be at a danger level by a sound meter that determines the decibel (unit for measuring sound) level.

Workers using tools with revolving parts, such as circular saws, drills, or grinders, should never wear jewelry, frayed or loose clothing, gloves, or long hair that could become tangled in moving parts of tools. Fire-resistant clothing that is in good condition and free of solvents, oil, or other flammables will protect the worker from sparks thrown from power tools.

ACTIVITY 10:

List three types of protective clothing to be worn when working with power tools.

1. _____
2. _____
3. _____

OBJECTIVE 11: Name two ways that power tools should be stored.

Power tools may run on electricity, compressed air, gasoline, hydraulic power, or be powder-actuated. In all cases, a worker using them must concentrate on the job, since even one slip could cause a serious injury. The high-speed, moving parts of the machine are dangerous. The power behind the moving parts — electrical energy, compressed air, gasoline — can be dangerous, too.

Listed below are general precautions to take when using power tools:

1. Disconnect the power before changing attachments on the tool and replace and adjust guards before connecting the tool up again.
2. Power tools must not be left in an overhead place where a dangling cord or hose might cause the tool to be pulled off accidentally; neither should the tool be left on the floor with the cord in a position to cause someone to trip and fall.
3. Power tools should be stored so that:
   - Cords and hoses are hung on hangers (not on nails, bolts, or other sharp edges) or laid on the floor between protective strips.
   - Points, sharp edges, and blades are protected and not touching other tools or placed where they can be struck by material being handled.

Certain safety measures for power tool use and storage are required by the Occupational Safety and Health Administration (OSHA) and apply to many power tools:

- Tools must be kept in a safe condition (the responsibility of the employer).
- Tools with guard(s) shall have the guard(s) in place when the tool is in use.
- Workers exposed to certain hazards must wear personal protective equipment, meeting standards described in the federal regulations for the industries concerned.
- Hand-held power tools must be equipped with ON-OFF switches.
- Tools such as circular and chain saws must have a switch so that power is immediately cut off when pressure is released.

ACTIVITY 11:

Write true or false beside the following:

1. Cords and hoses should be hung on nails. _____
2. Points, sharp edges and blades should be protected. _____
3. Cords and hoses may be laid on the floor between protective strips. _____

OBJECTIVE 12: Name two ways to prevent electric shock when working with electrical power tools.

Tools are grouped according to their source of power:

Electric tools such as drills, saws, grinders, and sanders.

Pneumatic tools such as jackhammers, riveting guns, small air hammers, and grinders.

Hydraulic tools such as jacks.

Gasoline tools such as chain saws, weeders, pumps, and compressors.

Powder-actuated tools such as fasteners, hole punching and rivet-tightening tools used with concrete, metal, masonry, brick, and wood.

Electric shock — the built-in danger of electric power tools is best prevented by keeping tools running properly and making sure they are grounded. Insulated rubber gloves, mats, and insulating platforms of various materials provide extra protection, especially when tools are used in wet places. Insulated gloves should be checked constantly for worn spots. Jewelry, which can conduct electricity, should not be worn when working with electric power tools.

All electric power hand tools must be grounded to prevent injury to the worker or to the tool. An ungrounded electrical power tool can cause an electric shock — and possibly death — if enough electric current passes through the worker's body.

Most modern tools have a third wire (grounding wire) built into the cord to protect the worker from electric shock. One end of the grounding wire is attached to the tool housing and the other to a special three-prong plug that fits the outlet of a grounded wiring system, as illustrated in Figure 18.

The grounding prong (or third prong) of a three-conductor cord should NEVER be removed to match a two-conductor outlet. Instead, a grounding adaptor should be used to convert the two-conductor outlet. A short "pigtail" wire as shown in Figure 19 must be connected to a suitable ground before the adaptor can be considered grounded.

Figure 18. A three-conductor cord used with a three-conductor outlet.

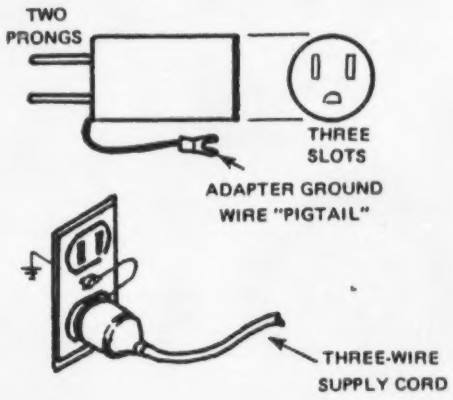

Figure 19. Proper use of a grounding adaptor.

Many modern tools are "double insulated," and do not need third-wire grounding. These tools are permanently marked by the words "double insulated" or by the symbol .

Electric cords should be inspected daily and damaged ones removed from service, because damage to electric wiring or insulation can cause the metal parts of any tool to become conductors of electric current.

The rubbing or cutting parts of saws and grinding tools cause many injuries. To protect the worker, portable grinders and saws must have wheel or blade guards. Workers must be trained to keep the working parts of small electric tools away from their clothing and bodies.

Sanders of the belt or disc type can cause serious injuries if the rapidly moving tool parts touch the worker's body. The sander should never be started before it has been grasped firmly and placed on the work. When in use, it should always be kept away from the body and clothing. Shirts with sleeves below the elbow should never be worn around power sanders.

Sanders also make dusts which can be harmful if breathed, so a respirator certified by NIOSH, (National Institute of Occupational Safety and Health) should be provided on the worksite. Since dust can catch on fire in certain cases, a fire extinguisher should also be on hand.

Workers should wear protective eyewear during sanding. Sanders in daily use should be cleaned daily with a vacuum cleaner. For special safety standards for grinders, abrasive (rubbing) wheels and their uses, check with the Code of Federal Regulations for the industry involved.

Soldering equipment may start a fire, causing burns or illness from breathing fumes. Special precautions should be taken to exhaust fumes and smoke from the work area. Lead soldering is especially dangerous, and special rules for exhaust from it must be followed.

ACTIVITY 12:

Name two ways to prevent electric shock when working with electric power tools.

1. _____
2. _____

OBJECTIVE 13: Name two hazards that are present when the air hose of a pneumatic tool is suddenly disconnected or cut.

Pneumatic (air-powered) tools present some of the same hazards as electrically-powered tools, plus some that are unique. For example, the air hose of a pneumatic tool presents a great hazard since it may be stumbled over or caught and pulled by other workers.

Air hoses should be routed overhead and not left on the ground where they could be run over and cut by vehicles. A broken hose flying freely can strike and injure a worker, as well as causing dust and particles of materials to blow about, creating a hazard to the worker's eyes and lungs. An interlocking safety connector, similar to the one shown in Figure 20, will prevent the air hose from coming undone by accident.

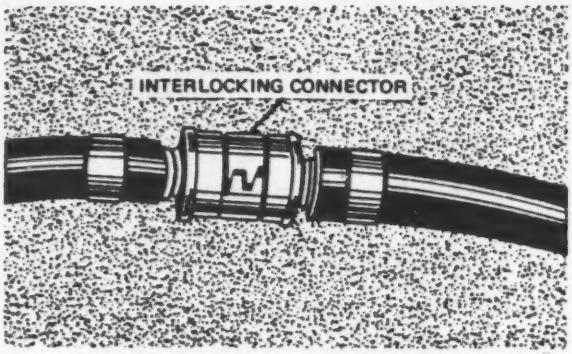

Figure 20. An interlocking safety connector for an air hose.

Operators of pneumatic tools, such as jackhammers and riveting guns, should wear safety goggles, ear shields, and safety shoes for protection.

When using a jackhammer, workers should never face each other nor should any worker stand in front of a jackhammer or point a jackhammer toward another worker. The tool should be turned on only when it is resting securely against the work.

Two safety devices must be on all jackhammers: (1) a safety trigger placed inside the handle where there is no chance that it can be pushed down by accident, and (2) a retaining device to prevent the drill from being shot from the barrel by accident.

Other air-powered tools such as nailers and staplers often cause injury when they are set off by accident. Safety goggles and screens protect the operator and co-workers from flying chips and fasteners. Detailed regulations for pneumatic tool operation appear in 29 CFR 1926.302, Section B, items 1-9.

ACTIVITY 13:

Name two hazards that are present when the air hose of a pneumatic tool is suddenly disconnected or cut.

1. _____
2. _____

OBJECTIVE 14: Name one precaution to take when using a hydraulic jack.

The danger in using a hydraulic jack comes not only from the very high fluid pressure contained, but also from (1) using a jack that is too small for the job, and (2) using a jack to hold a heavy load instead of merely to raise the load, as is the intended use.

Caution should be taken when using machines and equipment where fluid pressure is transmitted through flexible lines. The lines should be inspected regularly for small leaks that allow the escape of hydraulic oil that can penetrate the skin and damage eyes.

ACTIVITY 14:

Name one precaution to take when using a hydraulic jack.

_____

OBJECTIVE 15: State the main hazard associated with use of gasoline-powered tools.

Gasoline-powered tools, such as chain saws, welders, pumps, and compressors present safety hazards because the gases from them can cause fires or explosions. These tools should be used only in well-ventilated areas and refueled only after the engine of the tool has been allowed to cool down. Spilled fuel should always be flushed away quickly.

ACTIVITY 15:

State the main hazard associated with use of gasoline-powered tools. _____

OBJECTIVE 16: Name the person permitted to operate a powder-actuated tool.

Powdered-actuated tools such as the one shown in Figure 21, are activated in much the same way as firearms, and the hazards of these tools are similar to those of firearms. A measured powder charge drives studs, bolts, nails, and other fasteners into materials such as concrete, steel, and brick.

Figure 21. A powder-actuated tool — showing the tool, a type of fastener, and the blank load.

The handling and storage of powder-actuated tools must be done with great attention to safety; such tools may discharge accidentally, richochet, and produce flying particles of material or dirt.

Only licensed operators are permitted to work with powder-actuated tools. Operator qualifications and other requirements are outlined in ANSI A10.3 (American National Standards Insitute). The operator must show a current operator's card before receiving permission to operate the tools.

Safe operating practices for the use of powder-actuated tools are the following:

- Toolroom supervisors shall give out such tools only to persons identified as qualified operators.
- If the tool misfires, it must be held in operating position for at least 30 seconds. Try to fire the tool a second time while continuing to hold it in a firing position. If the tool misfires the second time, wait another 30 seconds with the tool still held in the firing position. If the tool continues to misfire, carefully unload the cartridge and place it in a container of water.
- The operator and other workers in the immediate area must wear safety goggles and hard hats that meet OSHA standards.
- When using the tool in small or confined spaces, ear protection should be worn.
- A powder-actuated tool must not be operated in an explosive or flammable atmosphere.
- A tool must not be loaded until it is ready to be used.
- The tool should always be pointed in a safe direction — loaded or not.
- Possible danger to nearby workers must be considered.
- The tool must be treated as a firearm at all times.
- The blank cartridges should not be used in normal firearms.
- The tool and cartridges must be stored in a dry, safe place.

Operators must see that the tool is clean, that all parts operate freely, and that the barrel is clear of obstructions. Any defect is cause for immediate withdrawal of the tool from use.

Additional information concerning lawful safety procedures for powder-actuated tools is found in 29 CFR 1926.302, section 3, 1-12 and in 29 CFR 1910.243.

ACTIVITY 16:

Write true or false beside the following:

1. The person permitted to operate a powder-actuated tool must have a license. _____
2. Powder-actuated tools work in much the same way as firearms. _____
3. It is safe to leave a tool loaded when it is not in use. _____
4. If a tool misfires, throw it away. _____

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National Safety Council. Accident Prevention Manual for Industrial Operations. 7th ed. Chicago: National Safety Council, 1974.

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ANSWERS TO ACTIVITIES

ACTIVITY 1

1. The employee should know how to properly use each tool that is dispensed.
2. The employee should know how to recognize damage to tools that are in inventory.

ACTIVITY 2

1. Using a defective tool.
2. Using the wrong tool for the job.
3. Improperly using the right tool.
4. Improperly maintaining tools.

ACTIVITY 3

Grip a hammer near the end of the handle, because the force of the blow is determined by the weight of the hammer and the distance it travels.

ACTIVITY 4

Any five

1. Do not use a screwdriver to check for current flow.
2. Do not use a screwdriver as a chisel.
3. Do not use a screwdriver to punch holes.
4. Do not use the handle of a screwdrive as a hammer.
5. Do not use a screwdriver that does not fit the size of the screw.
6. Do not drive the screw in farther than needed to seat it firmly.

ACTIVITY 5

The added leverage can cause the wrench to break.

ACTIVITY 6

Backwards.

ACTIVITY 7

Push a sleeve of rubber padding over the chisel, above worker's grip.

ACTIVITY 8

The chisel will chip or crack.

ACTIVITY 9

Away from or out of line with the body.

ACTIVITY 10

Any of the following:

Safety shoes.

Helmets.

Face protection (goggles).

Industrial safety glasses.

Hearing protection (ear muffs or earplugs).

ACTIVITY 11

1. False.
2. True.
3. True.

ACTIVITY 12

1. Proper tool maintenance.
2. Adequate grounding.

ACTIVITY 13

1. The air hose can whip about and injure workers.
2. The air hose can blow about harmful dust and particles.

ACTIVITY 14

Any one of the following:

Use a jack that is big enough for the job.

Never use a jack to hold a heavy load.

Inspect lines regularly for leaks.

ACTIVITY 15

Fire or explosion.

ACTIVITY 16

1. True.
2. True.
3. False.
4. False.